

PART 4 A

PARTICULAR INSTRUMENTATION & CONTROL REQUIREMENTS

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PART 4A

PARTICULAR INSTRUMENTATION & CONTROL REQUIREMENTS

4.1 Instrumentation System

This section outlines the particular requirements for the instrumentation systems. Unless specified in this section to the contrary instrumentation Plant provided by the Contractor and workmanship shall comply with the General Chapters of these Requirements.

The scope of instrumentation, control and automation (ICA) works for **20 MLD part of 80 MLD Sewage Treatment Plant at Kengeri** shall comprise of supply, installation, testing and, commissioning of Field instruments such as DO Analyzer, ORP Analyzer and Sludge Blanket Monitor as per specification. The instruments and working status of electrical equipment in MCC panels shall be connected to the local PLC for integration with Plant SCADA system.

4.2 Field Instrumentation and Control

Each field instrument shall be operable in local mode and have display functions in SCADA. The Contractor shall be responsible for providing the appropriate signals at the locations required to provide the specified control and monitoring functions.

The Contractor shall ensure that field measuring systems shall respond quickly to any changes of the measured process variables.

All field instruments shall, as far as practicable, be mounted in a location that shall be free of vibration and shall be powered from the instrument control system.

24V DC power wiring for field instruments shall be individually fused and provided with a means of disconnecting the power without disturbing terminated wiring (e.g. knife-switch-type terminal blocks). Visual indication of a blown fuse condition shall be provided.

All field instrument components shall be of a proven and reliable design and shall have a high degree of uniformity and shall, wherever possible, be interchangeable. The design shall facilitate easy maintenance and repair, taking into account the availability of access routes through plant and structures generally.

Field Instruments shall perform sensing, indicating and transmitting. The devices shall generally interface with the SCADA, either directly or indirectly. The materials of those parts of the field instruments, including piping material, which are exposed to the measured media shall be compatible with the conditions of the respective media and of the ambient fluid and atmospheric conditions.

All field instruments shall be mounted within enclosures that are corrosion proof, dust proof and waterproof to provide a minimum protection specified in elsewhere in this Specification.

All field instruments, including the components, shall be tropicalised and designed for the ambient conditions detailed elsewhere in this Specification. Lighting protection barriers shall be used for protecting transmitters and receiving instruments from the surge voltage due to lighting strike. Lighting protection barriers shall be supplied at both receiving and sending ends for all signals from outside building and those installed between the buildings.

4.3 Instrumentation Design Criteria

The design criteria to be applied to instrumentation systems shall be as follows:

- all instruments shall be suitable for continuous operation;
- all transmitting instruments shall have a 4 - 20 mA linear output;
- all digital outputs shall be volt free;
- all instruments shall be designed for the ambient conditions of temperature and humidity;
- all wetted parts of instruments sensors shall be non-corrosive and suitable for use with sewage;
- all instrumentation systems for use out of doors shall be protected to IP 65;
- all analogue displays shall be of the digital type with no moving parts utilising back lit liquid crystal diode LCD / LED technology;

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- instrumentation shall utilise solid state electronic technology and avoid the use where practical of any moving parts;
 - minimum maintenance requirement;
 - instrumentation shall resume operation automatically on the application of power following a power failure.

Instrumentation sensors shall be suitable for the environment in which they are expected to work. Sensor located in hazardous (flammable) or potentially hazardous atmospheres shall be certified for use in these areas. Sensors should be of self-cleaning type.

Instrumentation converter units shall where practical be located in the associated MCC common control panel well away from any injurious effects of the process.

4.4 Flow Measurement and Control

The Contractor shall use electromagnetic flow meters, Ultrasonic flow meters or as approved by the employers representative as the standard flow meters under this contract. Each flow meter shall be installed in the pipeline. The flow meter system shall provide flow rate and totalized flow indication.

The pressure rating of the flow meter and flanges shall be equal to or greater than that of the pipeline within which it is installed.

The preferred location for the flow meter converter/transmitter units and converter shall be installed in a suitable above ground enclosure providing the converter with suitable mechanical and environmental protection.

The flow signal converters/transmitters shall provide 4-20mA output linearly proportional to the rate of flow and shall provide a pulse output for flow totalizing. The flow meter electronic supervisory unit shall display the following on a minimum:

- Flow rate;
- Flow total/totalizer;
- High flow rate alarm;
- Low flow rate alarm.

Signals for the items above shall form inputs to the PLC and SCADA and be utilized within Operator displays. The integrator used for the second item above shall have at least six digits.

Each flow meter shall be provided with downstream and upstream isolation valve including the washout facility.

4.5 Terminal Sewage Pumping station Control

The terminal sewage pumping station (TSPS) is equipped with a redundant Programming logical controller(PLC) to monitor and control the day to day operations of the TSPS. The TSPS PLC is linked with a redundant serial communication link with the main plant STP hot-standby PLC. The digital and Analog signals shall be connected to the Local PLC I/O ports.

The minimum processes and I/O that shall be controlled and monitored by the TSPS PLC are as below:

1. Coarse screen & screening conveyor
2. TSPS pumps
3. Medium screens & conveyor
4. Grit basins & conveyor

Pump, Motor: Start, Stop, Auto /Manual, Run, Emergency Stop, Fault

Valve: Auto/Manual, Open, Close, Travelling Indication, Fault

Drives/VFD: Start, Stop, Auto /Manual, Run, Emergency Stop, Fault, speed, voltage/current

Flow Indicator/Transmitters (at common discharge end of pumps, Analog value, totalizer, Alarm

Emergency Stop: pumps, valves. Drives, motor, etc...

4.6 Blower system Instrumentation & Control:

The blower system shall be supplied with a local control unit. The local control unit shall be integrated by means of redundant serial link with the STP SCADA for remote monitoring and control of the blower control system. The serial communication system shall be based on internationally Implemented standards. The design of communication system chosen shall ensure that there is sufficient capacity and facilities to enable the system to achieve time-stamping and response performance.

All alarm and status indication shall be indicated on the STP SCADA

The typical I/O or instrumentation to be provided shall include on a minimum pressure transmitters on the individual outlet of blowers along with pressure gauges, pressure transmitter and air flow meter on the common discharge outlet,

The STP contractor shall ensure that data from the blower control system can be read and displayed at the Station SCADA. Ethernet communication shall be used to communicate with the local automation system. The above feature should be demonstrated during FAT& SAT.

4.7 Analytical Instrumentation & Measurement

4.7.1 DO Measurement/Analyzer

(a) Aeration Tank DO

(i) General

Service	:	Measurement of Dissolved Oxygen in the aeration tank.
Repeatability	:	± 0.2 mg/L
Range	:	0 - 20 mg/L

(ii) Sensor

Type	:	Immersion Type
Mounting	:	In aerobic tank
Installation hardware and Integral cable	:	Required
Probe material	:	Suitable for Sewage application

(iii) Transmitter

Type	:	Microprocessor Based having back Lit LCD display
Mounting	:	Field
Prefabricated integral cable for connecting sensor and transmitter	:	Required
Analog outputs	:	4 -20 mA

4.7.2 ORP Measurement/Analyzer

(b) Anaerobic Tank ORP

(i) General

Service	:	Measurement of Oxidation Reduction Potential in the anaerobic tank.
Repeatability	:	± 20 mV
Range	:	- 2000 to + 2000 mV

(ii) Sensor

Type	:	Immersion Type
Mounting	:	In anaerobic tank
Installation hardware and Integral cable	:	Required
Probe material	:	Suitable for Sewage application

(iii) Transmitter

Type	:	Microprocessor Based having back Lit LCD display
Mounting	:	Field
Prefabricated integral cable for connecting sensor and transmitter	:	Required
Analog outputs	:	4-20 mA

4.8 APPROVED VENDOR LIST FOR INSTRUMENTATION

The naming of a manufacturer in this specification is not intended to eliminate competition or prohibit qualified manufacturers from offering equipment. Rather, the intent is to establish a standard of excellence for the material used, and to indicate a principle of operation desired.

S.	DESCRIPTION	VENDOR/MANUFACTURER/
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NO		MAKE
1	Flow meters/Flow Indicator/ Transmitter	M/s EMERSON M/s ABB M/s Royce Instruments M/s Siemens M/s Dynameters M/s Pulsar M/s Yokogawa M/s Endress+Hauser M/s Forbes Marshall
2	Online Residual Chlorine Analyzer	M/s Hach Company M/s SWAN M/s HF SCIENTIFIC, INC M/s Endress+Hauser
3	Analytical Online Instruments (DO, ORP, etc.)	M/s Hach Company M/s Jenco M/s Endress+Hauser M/s ABB M/s SWAN M/s HF SCIENTIFIC, INC M/s Siemens M/s WTW M/s Toshcon

In order to achieve standardization for appearance, operation, maintenance, spare parts and manufacturer's service, like items of equipment provided hereunder shall be the end products of one (1) manufacturer.

4.9 Process Plant Operation Philosophy

1. General Control Philosophy

This section describes the control philosophy for the sewage treatment plant at Kengeri for tender purposes only. This information is not intended for construction and is indicative only.

The sewage treatment plant at Kengeri is designed to operate in fully automatic (auto mode) of operation at all given times. In the event of failure of the same, facility is provided to operate the plant in manual mode till such time the auto mode is again available. The design incorporates level, flow and pressure interlocks to ensure plant is operated in a safe condition at all times and to ensure maximum uptime.

2. Terminal Sewage Pump Station / Head works

The data from TSPS shall be communicated to the STP, main plant PLC based SCADA system via redundant FOC cable network.

2.1 Coarse Screens

Hand operation type gates will be installed both upstream and downstream of the coarse screens so that each screen channel can be isolated for maintenance. The inlet and outlet gates will be manually operated by the operator with wheel handles.

The coarse screens will be installed in the screen channels in two-duty with one-standby configuration to remove debris from the influent raw sewage.

The coarse screens will run under an auto mode upon detection of pre-set differential levels between pre- and post-screen or a pre-set time relay, which are programmed in a PLC. The screens can be operated manually by the operator at a local control panel located adjacent to the equipment during trouble shooting or maintenance or at the STP SCADA HMI. The raw sewage levels of the pre-screen and the post-screen in the screen channels are continuously monitored by ultrasonic type level sensors/transmitters.

2.2 Screening Conveyor

The screenings conveyor will be installed beneath the coarse screens to dispose the screenings to the screening skip after receiving it.

The screening conveyor will operate in Auto mode in linkage with the coarse screens. The screening conveyor can be operated manually by the operator at a local control panel located adjacent to the equipment for trouble shooting or maintenance, or at the STP SCADA HMI via the PLC based SCADA system.

Alarms/faults and status shall be monitored/logged and control commands shall be generated in several levels in I/O list, which shall be proposed as per neatly organized criteria by the Contractor.

2.3 Sewage Pumps

The sewage pumps would operate in an Auto mode upon detection of pre-set sewage levels in the wet well. Four sewage levels will be pre-set as pump start triggers, H1 for the lead pump start, H2 for the second pump start, H3 for the third pump start and H4 for the fourth pump start at the STP SCADA HMI. Another four levels will be pre-set as pump stopping levels, L1 for the lead pump, L2 for the second pump, L3 for the third pump and L4 for the fourth pump at the STP SCADA HMI. The lead pump and following pumps can be set by the operator at the STP SCADA HMI.

Upon detection of a higher level in the wet well, a pre-set greater number of pumps would be set in to operation.

The Two new pumps shall be driven by VFD (Variable Frequency Drive), which can control discharge flow or can achieve the level constant control.

The two pump speed will be controlled by VFD (Variable Frequency Drive) within a given level and flow range to smooth the flow to the STP. The sewage pump operation under auto mode is achieved by the PLC in combination with the level meter, pressure and the flow meters.

A pressure transmitter shall be installed on the individual discharge lines to achieve pressure interlocks for control and monitoring purposes.

The sewage pumps can be operated manually by the operator at a local control panel located adjacent to the equipment during trouble shooting or maintenance, or at the STP SCADA HMI. For example if the STP fails to operate, then the pumps delivering flow to the STP can be stopped.

Pressure gauges & pressure transmitters shall be mounted on the discharge pipes of the sewage pumps for monitoring and alarming.

2.4 Medium Screens

The medium screen facility is of a bar, stepper type screens with 6 mm opening, flushing water pipelines equipped with solenoid valves, pre-screen level meters, post-screen level meters and ancillaries.

The medium screen will operate in an auto mode upon detection of a pre-set differential liquid level between upstream and downstream of the screens or upon a pre-set time relay set point. The medium screen will also be operated manually by the operator at the local control panel located adjacent to the equipment during trouble shooting or maintenance, or at the STP SCADA HMI.

The flushing valve will open/close in the auto mode in linkage with the associated screen running condition. The medium screens can be operated manually by the operator at a local control panel located adjacent to the equipment during trouble shooting or maintenance. The flushing valve will also be operated manually by the operator at the above local control panel.

Removed screenings/debris will be washed prior to being disposed into the skip. If sewage level in the inlet channel rises due to screen failure or maintenance issues, an alarm is generated by a level meter installed in the common channel and is shown on the STP SCADA HMI in the administration central control room for the operator to react it.

2.5 Screenings Conveyor for Medium Screens

The screw conveyor shall be installed just beneath the medium screens so that it can convey the screenings into a skip for disposal out of the STP.

The conveyer will operate in an auto mode in association with the medium screens. The conveyer will also be operated manually by the operator at the local control panel located adjacent to the equipment during trouble shooting or maintenance, or at the STP SCADA HMI.

2.6 Grit Collectors

The grit collectors shall be installed in the grit chamber to collect settled grit into a pit at the middle of the chamber by rotating scraper.

The grit pumps will run continuously in an auto mode if the STP is in service. The grit pumps can be operated manually by the operator at the local control panel located adjacent to the equipment during trouble shooting or maintenance, or at the STP SCADA HMI.

The de-gritted sewage overflows a partial flume followed by a distribution chamber, which deliver the sewage evenly to the primary clarifiers for biological treatment. The sewage flow will be measured continuously at the partial flume with an ultrasonic type level transmitter and a level-flow converter.

2.7 Grit Washers/Classifiers

The grit in the grit channels will be conveyed to the grit washers by gravity for further treatment and final disposal. The grit washer is an inclined channel type or a trough with rake type equipped with flush water line, organic return line and drain line. There will be motorized valves mounted on the above pipelines to make the grit washers/classifiers system complete.

Two grit washers shall be installed in appropriate places just beneath the grit chambers to wash and compact grit. Motorized plug valves will be installed on the grit feed line, organics return line and drain line for guiding the grit to the washer, for returning the organics and for draining washed water from the washer respectively. The grit washers will operate in linkage with the associated grit chamber. A flush water system will be installed to wash the grit prior to dumping to a grit skip for final disposal. Subsequently the used flush water will be discharged into the main process flow stream.

The grit washers/classifiers will continuously run in an auto mode in linkage with the grit collector running condition. The flushing valve will open/close automatically in the auto mode in linkage with the grit washer. The belt/crew conveyers will also operate in the auto mode in linkage with the grit washers for dumping the washed grit to the skit.

The grit washers/classifiers will be operated manually by the operator at the local control panel located adjacent to the equipment during trouble shooting or maintenance, or at the STP SCAD HMI. The flushing valves, the organics return valves and the drain valves can be manually operated by the operator at the

local control panel located adjacent to the equipment during trouble-shooting or maintenance, or at the STP SCADA.

3. Biological Treatment Process

The biological treatment process comprises primary clarifiers, aeration basins, three secondary clarifiers and one chlorine contact tank as major structural zones. To make the biological treatment process complete, there are process air blowers, mixed liquor recycle pumps, return activated sludge pumps, waste activated sludge pumps installed as major equipment on the above structures.

The clarifiers with center driven type will be installed in the primary sedimentation tanks. Each aeration tank consists of individual rectangular zones used to stimulate plug flow. The mentioned zones function as anoxic, anaerobic and aerobic process respectively. The anoxic zones facilitate denitrification while the aeration zones facilitate BOD removal and nitrification.

The anoxic zones and the aerobic zones are equipped with baffles and mixers so that they can expedite zigzag flow and can keep solids in uniform suspension within the zones. Meanwhile, the aerobic zone is equipped with air distribution headers and is not separated by baffles.

The biologically treated water enters the secondary clarifiers after overflowing to the peripheral channel. The clarifiers with center driven type collect the settled sludge into pits located at the center bottom of the secondary sedimentation tank. The settled sludge is drawn out of the liquid process as the waste sludge to the sludge treatment process. Alum solution is dosed at the effluent point of the tanks for phosphorous removal. The treated effluent enters the chlorine contact tank where chlorine solution is applied for disinfection as final process point before the effluent is discharged out of the STP.

Pre treated sewage in the head works enters the primary sedimentation tanks through dedicated lines. The primary treated sewage in the primary sedimentation tanks enters the aeration tanks where the influent is treated in the biological process. Air is supplied by the process air blowers to the aerobic zones of the aeration tanks.

Mixed liquor is recycled from the aerobic zones to the anoxic zones within the aeration tanks by the MLR pumps to facilitate denitrification in the anoxic zones. Return activated sludge from the secondary sedimentation tanks is returned to the head of the aeration basins to maintain the desired solids retention time (SRT) and the intended MLSS concentration.

The sewage in the aeration tanks shall be monitored continuously through the following water quality analyzers mounted;

- Online ORP analyzer , shall be installed at aerobic zone, and the end of the aerobic zone,
- Online DO analyzers shall be placed at the aerobic zones.

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- Online MLSS analyzer shall be installed at both the inlet and the outlet end of the aeration tanks.

All analyzers under this contract shall be single channel analyzers only. Contractor shall note the importance of this requirement.

3.1 Primary Clarifiers

The primary clarifiers shall be installed in the primary sedimentation tanks for collecting the settled sludge into the pit at the bottom centre of the tanks.

The clarifiers shall run continuously in an auto mode when the tank is in service. They can be operated manually in the field at the local control panel, or remotely at the STP SCADA HMI.

3.2 Primary Sludge Pumps

The primary sludge pumps shall be installed in an appropriate place near the primary sedimentation tanks. The suction line of the primary sludge pumps shall be connected to the bottom centre pits of the primary sedimentation tanks through the suction common header to extract the primary sludge to the gravity thickeners.

The primary sludge pumps shall be controlled in two auto mode options provided, one is like a continuous operation mode or the other is like a batch operation mode respectively.

In the continuous operation auto mode (option 1), the primary sludge pumps will run continuously as per the appropriate set point of extract flow given to the PLC by the operator. The PLC is located in the central control room at the administration building. Primary sludge flow rate will be controlled automatically through VFDs, which drive the primary pumps, in the auto mode as per the set point available in the plant PLC. In the batch mode (option 2), the primary sludge pumps will start/stop automatically as per pre-set time relays or pre-set totalized primary sludge quantities to be extracted.

The primary sludge flow will be continuously monitored through flow meters, which will be mounted on the discharge lines to gravity thickeners and to the distribution tanks before the primary clarifiers. The measured instant flows are fed back to the PLC as process values in the flow control algorithm.

The primary sludge pumps can be manually operated by the operator at a local control panel located adjacent to the equipment during trouble shooting and maintenance, or at the STP SCADA HMI. The set value of the VFDs will also be set manually by the operator at VFD panels.

3.3 Organic Return Valve

Organics return valve shall be installed on the primary sludge return line to the distribution tanks for the primary clarifiers.

The organic return valves will be controlled in an auto mode as per the set point of return flow given to the PLC by the operator at the STP SCADA HMI. The adequate return flow set point will be obtained in try-and-error method during the operation and maintenance period after commissioning of the STP construction. A position meter will be built in the valve for monitoring and control purposes.

The organics return valve can be operated manually by the operator at the actuator interface panel for trouble-shooting or maintenance.

3.4 Scum Pumps

Two scum pumps have been installed in the scum pits attached to the primary sedimentation tanks to transfer the scum to anaerobic digesters for anaerobic digestion process.

The scum pumps are controlled automatically in an auto mode upon detection of pre-set levels of the scum pits.

The scum pumps can be operated manually by the operator at the local control panel located adjacent to the equipment for normal service, or trouble-shooting and maintenance.

3.5 Mixers

The mixers shall be installed in the anoxic zones and the anaerobic zones of the aeration basins for maintaining solids in uniform suspension and generating horizontal-flows in zigzag formation within the zones.

The mixers shall run continuously in an auto mode when the basins are in service. Mixer's auto/manual status, running status shall be monitored and controlled by the PLC based SCADA SYSTEM. They can be operated manually in the field at the local control panel for trouble-shooting and maintenance, or remotely at the STP SCADA HMI.

3.6 Process Air Blowers and Diffuser Air Flow Control Valves

The one new process air blower and the diffuser air flow control valves shall be installed in the process air blower building and at appropriate location on air supply lines respectively to supply fine bubble air to the aerobic zones through air diffusers placed at the bottom of the basins.

The air blower and the flow control valves will be controlled automatically in an auto mode by the PLC targeting a desired set point of dissolved oxygen (DO), which process variable is obtained from the appropriate location of the aeration

basin based on the mode of operation. The DO set point will be given to the PLC through the STP SCADA HMI.

A flow control algorithm will also be programmed in the PLC to configure a cascade control system following the DO control algorithm. The measured DO value is compared to the set point in the DO control algorithm to generate error and output. The air flow control valves are modulated by the flow control algorithm to achieve the flow set point sent from the DO control algorithm by multiplying pumped sewage flow to the aeration basins and a certain ratio.

A pressure constant control method is provided at the common discharge line of the biological air blowers to avoid fluctuation in air supply to each aeration basin through the air flow control valves. The numbers of blowers required will run automatically in an auto mode by a sequence control in a linkage with the pressure control algorithm. One blower VFD out of the three blower VFDs in operation will be controlled as per the pressure set point in the pressure constant algorithm programmed in the PLC.

The pressure constant control will be achieved by controlling number of the blowers with modulating the VFD in cascade formation.

If, to maintain the header pressure to the set point, more air is required with first air blower operating at, say, 50 % frequency of the VFD, the VFD increase its frequency to 100% as required in the pressure control algorithm. If, to maintain the header pressure to the set point, more air is required, the second air blower starts with the VFD at 50 % in the sequence control. If, to maintain the header pressure to the set point, more air is required, the VFD of the second unit increase frequency to 100 % as per the pressure constant control algorithm.

A lead blower followed by second/third units and standby unit will be set at the STP SCADA HMI.

The process air blowers can be manually operated by the operator at a local control panel located adjacent to the equipment during trouble shooting and maintenance, or at the STP SCADA HMI.

3.7 Mixed Liquor Recycle (MLR) Pumps

The MLR pumps shall be installed in the outlet common channel of the aeration basins to recycle mixed liquor from the aerobic zones to the anoxic and anaerobic zones within the aeration basins.

The MLR pumps will run continuously in auto mode initiated at the main plant PLC.

The recycle flow rate will be automatically controlled through VFDs, which drive the MLR pumps in the auto mode as per the set point available in the plant PLC by multiplying the pumped sewage flow and a ratio to it. The ratio to

the sewage influent flow will be given to the PLC at the STP SCADA HMI by the operator.

The MLR pumps can be operated in a manual mode by the operator at a local control panel located adjacent to the equipment during trouble shooting and maintenance, or at the STP SCADA HMI. The set value of the VFDs will also be set manually by the operator at the VFD panels

3.8 Secondary Clarifiers

The secondary clarifiers shall be installed in the secondary sedimentation tanks for collecting the settled sludge into the pit at the bottom center of the tanks.

The clarifiers run continuously in an auto mode when the tank is in service. They can be operated manually in the field at the local control panel, or remotely at the STP SCADA HMI.

3.9 Return Activated Sludge (RAS) Pumps

Three new RAS pumps shall be installed downstream of the RAS pump station near the secondary sedimentation tanks to return the activated sludge from the tanks to the zones the common inlet channel and the inlet ends of the anaerobic zones of the aeration basins. The RAS pumps are also used to extract waste sludge to the gravity thickeners.

The RAS pumps will run continuously in an auto mode and be initiated at the main plant PLC. The return sludge flow rate will be controlled automatically through VFDs, which drive the RAS pumps, in the auto mode as per the set value available in the plant PLC by multiplying the sewage influent flow and a ratio to it. The ratio to the sewage influent flow will be set to the PLC at the STP SCADA HMI by the operator. The return flow rate will be continuously monitored through a flow meter mounted on the return pipe and be fed back to the PLC as a process value in a flow control algorithm.

The RAS pumps can be operated in a manual mode by the operator at a local control panel located adjacent to the equipment during trouble shooting and maintenance, or at the STP SCADA HMI. The set value of the VFDs will also be set manually by the operator at the individual VFD panels

3.10 Waste Activated Sludge (WAS) Valve

The WAS valve shall be installed on the WAS line to extract the waste sludge to the gravity thickeners. The WAS extract line will be tapped off the RAS pump discharge common header to transfer the waste activated sludge to the gravity thickeners.

The WAS valve will be controlled in two auto mode options provided, one is pre-set time relay control or the other is pre-set WAS extract quantity volume respectively.

The WAS valve will be controlled in the auto mode option 1 as per the pre-set time cycle relay and the duration time relay set to the PLC by the operator. In the auto mode option 2, the WAS valve will be controlled automatically as per the pre-set totalized waste sludge quantities.

The waste activated sludge flow rate will be continuously monitored through flow meters mounted on the waste sludge line and fed back to the PLC as a process value in the totalized flow quantity control algorithm.

The WAS valve can be manually operated by the operator at an actuator interface control panel built-in the actuator during trouble shooting and maintenance, or at the STP SCADA HMI.

3.11 Secondary Clarifier Scum Pumps

Two scum pumps have been installed in the scum pits attached to the secondary sedimentation tanks to transfer the scum to the anaerobic digesters for anaerobic digestion process.

The scum pumps will be controlled automatically in an auto mode upon detection of pres-set levels of the scum pits

The scum pumps can be operated manually by the operator at the local control panel located adjacent to the equipment for normal service, or trouble-shooting and maintenance.

4. Solid Treatment Process

The solid separated from the liquid process as the primary sludge and the waste sludge will be transferred to the gravity thickeners functioning as first step in the solid treatment process. Following the two gravity thickeners, there will be comprised of two anaerobic digesters, two gas/sludge storage tanks, two boilers for anaerobic digester heating, two dewatering centrifuges with polymer dosing system and ancillary equipment/devices to facilitate the solid process complete.

There will be a solid collector with center driven type equipped in each gravity thickener tank to collect thickened sludge into a pit at bottom center of the gravity thickener. The thickened/concentrated sludge will be transferred to the anaerobic digesters by thickened sludge pumps for anaerobic digestion process.

Two digester gas mixing blowers, one boiler, two hot water circulation pumps, one heat exchanger, sludge circulation pumps will be installed as major equipment to make up one mesophilic digestion system.

The anaerobic digested sludge will be conveyed to the gas/sludge storage tanks playing a role of buffer for the dewatering system following the anaerobic digestion process.

There will be two dewatering centrifuges, two polymer dosing systems, belt conveyer(s) and dewatered cake hopper(s) installed to facilitate the dewatering process for finally disposal out of the STP. Two plant drain pumps will be

installed in the plant drain pump station to receive filtrate/supernatant generated from any process in the solid treatment process and return them to the inlet common channel of the medium screens in the headworks for recycling within the treatment process.

4.1 Thickened Sludge Collectors

The thickened sludge collectors with circular center driven type shall be installed in the gravity thickener tanks for collecting the thickened sludge into the pit at the bottom center of the tanks.

The clarifiers run continuously in an auto mode when the tank is in service. They can be operated manually in the field at the local control panel, or remotely at the STP SCADA HMI.

4.2 Thickened Sludge Pumps

The thickened sludge pumps shall be installed in the thickened sludge pump station near the gravity thickeners to transfer the thickened sludge to the anaerobic digesters for anaerobic digestion process.

The thickened sludge pumps will run in an auto mode as per the flow set point set to the PLC by operator initiation at the STP SCADA HMI. Thickened sludge flow will be continuously monitored by flow meters for monitoring and as a fed back signal to the flow control logic for the thickened sludge pumps. The thickened sludge pumps will be operated manually in manual mode by the operator at local control panels for trouble shooting and maintenance, or at the STP SCADA HMI.

4.3 Thickened Sludge Feed Valves

The thickened sludge feed valves shall be installed on thickened sludge feed line tapped from the common discharge header line of the thickened sludge pumps to equalize thickened sludge flow to the two anaerobic digesters.

The thickened sludge feed valves will be modulated as per the flow set point available in the PLC by half rating of the thickened sludge flow measured by the two flow meters. The measured flow of the thickened flow is also utilized as the fed back to the flow control logic for the thickened sludge pumps as above mentioned.

The thickened sludge feed valves can be manually operated by the operator at an actuator interface panel built in the actuators for trouble shooting and maintenance, or at the STP SCAD HMI.

ABBREVIATIONS USED

AMF	Automatic Mains Failure
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API	Application Program Interface
CCS	Existing “Central Control Station” at Company’s facility in Al Ansab from where all the facilities of the company in each catchment area are being controlled and monitored.
CCTV	Closed Circuit Television
COM/DCOM	Computer Object Model/ Distributed Computer Object Model
BWSSB	Bangalore Water Supply and Sewage Board
CPU	Central Processor Unit
SCADA	Supervisory Control and Data Acquisition System
DDE	Dynamic Data Exchange
DLP	Data Loss Prevention
DO	Dissolved Oxygen
EMCS	Electromagnetic Compatibility Society
FBD	Functional Block Diagram
FOC	Fibre Optic Cable
GPRS	General Packet Radio Service
GRP	Glass Reinforced Plastic
GSM	Global System for Mobile
HMI	Human Machine Interface
IEC	International Electrotechnical Commission
I/O	Input / Output
ISO	International Standards Organization
IT	Information Technology
LAN	Local Area Network
MIS	Management Information System
MLD	Million Litres per Day-
MUX	Multiplexer
OPC	OLE for Process Control
ORP	Oxidation Reduction Potential
OSI	Open Systems Interconnect
PLC	Programmable Logic Controller
TSPS	Terminal Sewage Pumping Station
RAS	Returned Activated Sludge
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
STP	Sewage Treatment Plant
TCP/IP	Transmission Control Protocol/Internet Protocol
TE	Treated Effluent
VBA	Visual Basic for Applications
VFD/VSD	Variable Frequency Drive/ Variable Speed Drive
WAS	Waste Activated Sludge

Windows™

Microsoft Windows

XML

Extensible Markup Language

**TECHNICAL SCHEDULE
INSTRUMENTATION & CONTROL EQUIPMENT
(To be completed by the Bidder)**

Instrumentation & Control Equipments

S. No.	Description	Unit	Particulars
1	Level Measuring System		
(a)	Ultrasonic Type (i) Make and Model (ii) Beam Angle		
(b)	Piezoresistive Type Make and Model		
(c)	Capacitance Type Make and Model		
(d)	Conductivity Type (i) Make and Model (ii) No. of electrode		
2	Digital Level Display Unit		
(a)	Make and Model		
3	Pressure Gauges		
(a)	Make and Model		
(b)	Range	kg/cm ²	
4	Pressure Transmitter		
(a)	Make and Model		
(b)	Range	kg/cm ²	
5	Digital Pressure Indicator		
(a)	Make and Model		
(b)	Repeat Transmission output		
6	Pressure Switches		
(a)	Make and Model		

S. No.	Description	Unit	Particulars
7	Flow Measuring System		
(a)	Type, Make and Model		
(b)	Accuracy		
(c)	Principle of measurement		
(d)	Number of Paths		
(e)	Flow integrator and display unit Make and Model		
8	DO analyzer		
(a)	Make and Model		
(b)	Accuracy		
(c)	Principle of Measurement		
(d)	Cleaning Method		
9	ORP analyzer		
(a)	Make and Model		
(b)	Accuracy		
(c)	Principle of Measurement		
(d)	Cleaning Method		
10	Temperature Measuring System		
(a)	Make and Model		
(b)	Accuracy		
(c)	Principle of Measurement		
11	Instrument Control Panel & Junction Boxes		
(a)	Make and Model		
(b)	Pre- Fabricated		